EVALUATION OF RECIPE ADJUSTMENT PROCEDURES OF FIVE COMPUTER SOFTWARE COMPANIES

by

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B.S., University of Missouri-Columbia, 1983

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Hotel, Restaurant,
Institution Management and Dietetics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1987

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A11207 308913

ACKNOWLEDGMENTS

A special thanks goes to Dr. Debbie Canter, my major professor, for all her time, patience, and encouragement in helping me complete my thesis. I also wish to thank Dr. Mary Gregoire for her expertise in developing my research project and analyzing the data. It was also a privilege to work with Dr. Carol Setser on developing the sensory analysis for my research project.

Gratitude is extended to the Kansas State Residence Hall dietitians for all their support they have given me during graduate school. Sincere appreciation goes to Mary Molt for her guidance over the last four years and to Paige Sultemeier for always encouraging me when I needed it the most. A special thanks goes to the sensory panel for all their time and effort.

Finally, a special thanks goes to my husband, Kelly, for his understanding and patience during graduate school. It would have been difficult to finish without his support.

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INTRODUCTION

Standardized recipes have been an integral part of a successful foodservice operation. Efficient foodservice management requires many components. Standardized recipes have been recognized as one of the most important and effective of all tools in food production (1).

The majority of information on standardized recipes was presented in professional and trade journals during the 1950's. During this period, foodservice professionals were interested in developing procedures for recipe standardization programs to improve consistency and quality of their recipes.

Standardized recipes can be adjusted to meet production forecasts by the factor method or the percentage method. MacFarlane (1) noted if calculations of formula adjustment are correct, then there should be no change in percentages of ingredients when a formula is expanded to a larger quantity. Sager and Ostenso (2) stated any formula adjustment method requires time consuming, repetitive mathematical calculations.

Computers have become necessary for most foodservice operations today. Manchester and Sager (3) described one of the major areas for electronic data processing (EDP) in foodservice as quantity and quality control and recipe adjustment.

Paul and Pauler stated that sensory methods of evaluation are valuable tools in testing standardized recipes. Sensory methods can be used to determine whether foods differ in quality attributes such as taste, odor, juiciness, tenderness, and the extent and direction of differences found (4). The purpose of this research project was to determine if differences exist in the recipe adjustment procedures of computer software companies as by assessed analytical and sensory recipe evaluations.

Specific objectives of the research were:

- to compare computer adjusted cake recipe ingredient quantities
- to compare volume measures of the cakes
- to compare sensory evaluations of the cakes

REVIEW OF LITERATURE

Recipe Standardization

During the 1950's, food standards and preparation techniques were changing and palatability and nutritive value of food products were improving (5). Aldrich (6) recommended nine factors as essential in efforts to improve food quality: establishing quality food standards, training supervisors in quality standards, providing good recipes and clear directions, using high quality ingredients, checking of production continuously, controlling the final stages of production, using adequate equipment, keeping updated on new products and procedures, and maintaining high quality standards.

Aldrich (6) also stated many family size recipes could be adapted for quantity foodservice, provided the foodservice manager had the patience and perseverance necessary to approach the problem methodically. Recommendations for standardizing recipes from home-size to large quantity included establishing precise amount of weights and measures for recipe ingredients, determining production procedures, establishing standard portion size, testing the recipe, and defining quality standards for the recipe.

Cranmore (7) defined a standardized recipe as an approved recipe pattern which establishes ingredients, amounts and procedures, and which will assure consistent high quality food of proven acceptability to one's patrons. Her requirements of a good recipe for standardization included: high patron acceptability, simplicity in preparation and service, visual appeal, and cost acceptability by management.

Aldrich (8) stated that every recipe must fit the special requirements of foodservice for quantity portion size, total yield, and raw food cost. A tailor-made recipe, standardized for a particular operation, has seven important factors: a well arranged, uncluttered format; neat columns for ingredients; clear directions; orderly arrangement of ingredients; information about yield, pan size, baking time, and temperature; portion size; and serving instructions.

Recipe standardization was referred to by Caleva (9) as "formula cooking" and was based on scientific management. In formula cooking, science was substituted for the individual judgment of the cook and thus permitted management to select and train the cook instead of allowing him/her to develop in a haphazard way. Scientific management recognized that skill of a worker increased in quality and quantity when proper management tools such as standardized recipes were used.

By 1958, Jansen noted that sources for standardized recipes such as cookbooks were improving. Measurements were expressed in more exact terms, and formats used for writing recipes were changing. Many recipes were being written in step by step form, and cookbook authors were becoming more cost conscious in providing alternative ingredients. Equipment, such as measuring spoons and cups, was more readily available, which assured more accurate measurements and less variation in results (10).

New ingredients, convenience items, and foodservice equipment were appearing on the market saving time and energy. The popularity of these items was due to the amount of time and energy saved. All of the changes impacted on foodservice managers who were revising standardized recipes (10).

Methods of Adjusting Standardized Recipes

Aldrich (11) contended calculation for increasing a recipe should not be left to a busy cook. A slight error in recipe adjustment could cause failure, leading to the loss of materials and valuable time involved in producing the product. Aldrich and Callahan (12) noted that production control could only be obtained through careful, accurate adjustment of standardized recipes to give the correct yield.

Callahan (13) stated advantages of standardized recipes can be easily lost in the adjustment process. Mathematical steps involved in adjusting recipe yields can easily lead to errors, with resulting poor quality products. Standardized recipes must be accurately adjusted to give correct cost and quality control.

West et al. (14) describe the factor and percentage methods as two recipe adjustment procedures. Using the factor method to adjust a recipe, ingredients are generally changed from measurements to weights and multiplied by a conversion factor. The steps involved in converting a recipe using the factor method are as follows:

- Convert any measured ingredients to weight.
- Change the weight of each ingredient to ounces or parts of ounces.
- To decrease or increase the original recipe, divide the new yield by the original yield. The answer is the factor, which is used to adjust the recipe yield.
- Multiply the amount of each ingredient in the original recipe by the factor.

- Carefully change the new calculated weight of each ingredient back to pounds and ounces.

When using the percentage method, measurements for ingredients are converted to weights and the percentage of each ingredient of the total weight is calculated. McManis and Molt (15) describe the following step by step method for recipe adjustment using the percentage method:

- Convert all ingredients for measures or pounds and ounces to tenths of pound.
- Total the weight of ingredients in a recipe after each ingredient has been converted to weight in the edible portion (EP).
- Calculate the percentage of each ingredient in relation to the total weight. Repeat for each ingredient.
- Check the ratio of ingredients. Standards of ingredient proportions have been established for many items. The ingredients should be in proper balance before going further.
- Establish the weight needed to give the desired number of servings. It will be in relationship to pan size, portion weight, or equipment capacity.
- Cooking or handling loss may be added to the total weight needed.
- Multiply each percentage by the total weight to give the exact amount of each ingredient needed. Once the percentages of a recipe have been established, any number of servings can be calculated and the ratio of ingredients to the total will be the same.

Computer Applications for Foodservice

Ostenso (16) stated that dietary system objectives must be established and defined prior to design, implementation, and evaluation of a computer-assisted dietary management system. To determine procedures and areas of management in which computer assistance is feasible and applicable for a specific dietary department, management must develop foodservice objectives and analyze current manual procedures. After computer-assisted procedures have been implemented, periodic evaluations should be conducted and results of evaluations used as a means for improving and controlling computer-assisted procedures and implementation methods.

Hoover (17) expressed the feasibility of utilizing computers for nutritional analyses, patient care, foodservice systems management, dietetic education, and research. Using computer programs for tasks of numerical manipulation, report preparation, and routine decision-making has provided more time for dietitians to make complex decisions regarding patient care and systems management. Hoover also stated further research is expected in the following areas: uniform external cost accounting, labor cost accounting, facility layout and design, production forecasting, scheduling, patient education, and analytical reports that aid management in decision-making.

Food management computer applications include inventory control, production control, food cost accounting, and labor productivity analysis (17-21). Computerized production scheduling has been formulated for cook/freeze and for ready foods systems (22, 23). These computer production scheduling programs assist foodservice managers in scheduling production, personnel, and equipment to save time and money.

Utilization of high technology requires an understanding of realistic computer applications within the profession of dietetics and of the process involved in conversion to a computer-based operation (24). Hiemstra and VanEgmond-Pannell (25) stated that some of the potential savings for computer systems include reduced inventories, error-free recipe adjustment calculations, more precise meal projections, more rapid payments, and pre- and post-costing of menu items.

In a survey conducted by McCool and Garand (26), a direct relationship was found between institutional size and computer usage. Computers were used by about 90% of all institutions serving 10,000 or more meals per day. Tasks at larger institutions are repeated with greater frequency making them more suitable for computer applications.

Recipe computerization

A computerized food preparation system must be based on standardized recipes. Standardized recipes strongly influence the cost and quality level of the operation, determine the purchasing requirements for raw food products, provide a standard for production control, and dictate the food energy and nutrients presented to customers (27).

Daily routine tasks such as adjusting recipes and ordering food, can be accomplished more quickly and accurately by using a computer rather than manually. By using a computer to complete routine tasks, supervisors would have more time for actual supervision of production. Computer-assisted food management could effectively change and enhance the managerial decision-making process (28).

Using a computer for a recipe file is considerably easier than manually searching for, correcting and retyping recipes (29). Computer programs have been designed to decrease the time required to maintain and update a complete set of standardized recipes and to adjust standardized recipes according to daily production requirements.

Developed computerized recipe programs

Using a computerized recipe file enhances food production and ingredient control. A computer program developed by Sager (30, 31) for Army General Hospitals was written and tested for accuracy of adjusting recipes and ordering food for the production section, using quantity standardized recipes and a model foodservice operation. The computer program provided a computerized method for recipe adjustment, including conversion of decimals to usable unit sizes; listing of recipe ingredients according to sequence of recipe preparation; and a summarized daily food order. Coded standardized recipes, census figures, and food-type categories utilizing individual ingredients were the required input for the program. Sager (31) determined it was possible to use a computer for compiling and summarizing standardized recipe data necessary for quality and quantity control of food production. Using the computerized method provided accuracy and speed far exceeding that of human capability.

Recipe files developed at the University of Missouri-Columbia Medical Center include basic information about a recipe, specific information for each ingredient, and preparation procedure statements (29). General recipe information, recipe number and name, size and number of servings, cooked weight, codes relating to advance preparation requirements, and standardization status are included on the recipe. Ingredient information includes: food code, nutrient code, quantity of ingredient, yield factors for various stages of preparation, and advance withdrawal and preparation codes. Procedures for preparation are provided for each group of ingredients.

Research conducted by Kaylin (32) and Conklin (33) at the University of Missouri-Columbia Medical Center determined that it was possible to incorporate standardized preparation procedure statements into an existing computerized recipe file. When using a computer there is an advantage to developing a complete set of standardized recipes as two separately stored computer files for preparation instructions and ingredient data. Preparation instructions are required only by the production control system, while data on ingredients, amounts required for preparation, serving sizes and nutrient content are utilized by the food cost accounting and menu planning systems.

A study conducted by Torrence and Vaden (34, 35) at Kansas State University was to develop a computerized food item, recipe file, and ordering system adapted to a residence hall foodservice system. The feasibility of computerized recipe adjustment by the percentage method was also evaluated.

Data for development of the food item file were gathered from several sources and standardized. Food items used in recipes were coded, when applicable, for weight per cup, weight per order unit, order unit, yield factors, item number, item name, status, type, inventory code, recipe number, storage location, order group and group item data (35).

Recipe information contained in the recipe file included: general recipe information, ingredient information, and production information (35). Information included in the recipe file were: recipe number, name, number of portions, portion size, standardized status, maximum batch, minimum batch, recipe source, equipment needed for production, handling loss percentage, forecasting unit, suggested serving allowance, and weight per cup of recipe. Ingredient information contained individual item codes and weights needed in the recipe for the forecasted number of portions. Production information contained preparation instructions used for the computerized recipes.

The percentage method for recipe adjustment was restructured and applied at Kansas State University for the residence hall computer program (35). Ingredients are stated in terms of their percent of total weight and, therefore, ingredient proportions do not vary.

Computerized recipe format

Sager (30) stressed that recipes should be designed for easy reading and use. Ingredient amounts for recipes could be listed in weight, decimal fractions of a pound, or volume measures. The method used should be selected after careful evaluation of the food production situation.

When planning computer extension of ingredient weights and units, the numbers resulting from multiplication of ingredient amounts must be converted to meaningful weights and units (30). For example, when adjusting spice ingredients initially stated in ounces, it may be necessary to convert ounces to grams, tablespoons, or teaspoons when the number of servings is reduced.

The final computerized recipe format should be designed to include all data required by the food production employees (30). There is no preferred way to arrange data on computerized recipes, but data should be presented logically and arranged in an easy to read manner.

Computerizing standardized recipes can be initially time consuming but there are many advantages. Computerized recipes can be precisely calculated, quickly adjusted, and easily converted into procurement units (30). A computerized file of standardized recipes is essential for effective production control.

Before a computerized recipe program is implemented in a food-service, programs should be researched to determine what is available commercially at a reasonable cost (36). Because developing computer programs is time consuming and expensive, it would be advisable to adapt an already developed and standardized computerized recipe program.

Sensory Evaluation

According to Larmond (37) sensory evaluation involved human evaluation and measurement of physical stimuli. Sensory evaluation has been defined as a scientific discipline used to evoke, measure, analyze, and interpret reactions to those characteristics of foods and materials as they are perceived by the senses of sight, smell, taste, touch and hearing (38). The aim is to provide panelists with the optimal setting for unbiased judgment. Sensory analysts must use common sense and make adjustments for the conditions in his situation.

In foodservice management product, evaluation is an important aspect of a quality control program (39). Sensory evaluation can be used effectively to develop new menu items and to maintain quality of existing menu items. Trained sensory panels can be used to judge quality characteristics and differences among food items, and consumer panels can be useful in evaluating menu item acceptance and preference. For an effective quality control program, sensory analysis should be used for product evaluation.

A study conducted by Jacobi and Setser (40) evaluated household and foodservice methods of preparation and service of spaghetti. A trained sensory panel was used to evaluate spaghetti for appearance, mouthfeel, and texture using an unstructured line scale.

A research project conducted by Riley et al. (41) evaluated effect the type of school foodservice system had on the quality and acceptability of selected food items. An untrained student sensory panel was used to evaluate the acceptance of the food items appearance, flavor, temperature, and serving size. A trained sensory panel was used to evaluate sensory characteristics of food items for crispness, moistness, tenderness, and color.

A course was developed by Lee (42) to train foodservice employees in sensory evaluation methods. The instructional materials illustrated basic concepts of sensory evaluation. The course was developed to be used with a self-instruction unit for foodservice directors.

Sensory evaluation testing

Sensory panel members should meet the following requirements: be available and interested in participating, be able to detect the tested sensory factors, and be capable of producing consistent judgments (43). Candidates possessing the outlined requirements may need to be further objectively tested to qualify for panel work.

Number of samples served at one session is based on the test product and on the sensory evaluation method used (43). A larger number of samples with mild sensory characteristics can be tested at one session than test samples with strong sensory characteristics.

Presentation order for test samples should be randomized in difference tests, but some types of tests required a definite order of presentation (43). When using threshold tests, the mildest sample is tasted first and the strongest sample last, with gradual gradation of intensity in between.

When testing samples various preparation factors such as time and temperature of thawing or cooking should be standardized and kept constant (37). If samples are purchased, the best procedure is to purchase products in case lots so that uniformity is more certain (38). Controlling all aspects of sensory test sample preparation cannot be overstressed. Tested samples should have uniform preparation, form, appearance, texture, quality, size, and temperature.

Sensory evaluation requires intense concentration by the panel members. The testing area should be distraction free, quiet and comfortable (44). Strong smelling cosmetics should not be used by panelists and food preparation odors should be kept from the testing room. Smoking also should not be permitted in the testing room.

Types of sensory evaluation tests

Sensory analysts are responsible for planning, executing, and reporting the activities of sensory panels. A trained sensory analyst should have an educational background in sensory methods, statistical design and analysis (45). Sensory analysts decide what must be measured, then select the proper method to make the appropriate measurement (46, 38). After statistically analyzing the data, the sensory analyst will determine whether degree of confidence decisions can be made based on the data.

Sensory tests consist of two major classifications, affective and analytical (38). Affective tests evaluate the preference and/or acceptance of products. Affective test panels are untrained and are selected to represent a large target population (47). The panel receives no training for the testing and evaluates only a few samples at one-time basis. An untrained panel may vary in size but an average of 50 to 100 members should ensure a fair representation of a target market.

Analytical tests are used to evaluate laboratory products for differences or similarities and to identify and quantify sensory characteristics (38). Two major types of analytical tests include discriminative and descriptive. Both types of tests require experienced and/or trained sensory panelists.

A trained panel ranges from six to 12 members who must be available and willing to participate repeatedly (48). Trained panels are familiarized with test procedures which increase their ability to recognize, identify, and recall sensory characteristics.

Descriptive testing provides information about specific sensory characteristics using adjectives, numerical scales, and rankings (48). Tested samples should be described with a precise and concise list of adjectives (49). Affective terms should be avoided such as good/bad or pleasant/unpleasant. Product terms, such as coffee is coffeelike should also be avoided. Descriptive words or phrases when used as anchors should be uniformly understood by the panelists (50).

Sensory scientists and statisticians are constantly confronted with selecting rating scales and word anchors for questionnaires (50). Ideally, the sensory analyst develops a scale panelists or judges can consistently give a meaningful subjective judgment to the prescribed task.

METHODOLOGY

Research Design

This research project was designed to determine by analytical and sensory methods, if differences exist in recipe adjustment procedures used by computer software programs. A cake recipe was selected for testing because of the effect proportions of ingredients can have on the final product. A home-size recipe was selected for the quantity size because of frequency of use as a source for new recipes in institutional foodservices.

Several home-size recipes were prepared and tested to select a consistently high quality cake recipe. These cake recipes were prepared using the home-size equipment in a food science laboratory in the College of Human Ecology at Kansas State University. Baker's German chocolate home-size cake recipe was selected for use in the study because of the high quality characteristics of texture, volume, color, and taste.

Sample Selection

Computer company participation

Six micro-computer software companies (Appendix A) were selected at random and were contacted by phone to participate in the research project using a prepared statement (Appendix B). The research project was described to a representative of each company, stressing that the research results would not compare the computer programs, but only determine if differences exist between recipe adjustment procedures. Representatives were told research results would be shared with the participating companies and their consent was sought to use the company name in research publications. Companies were also asked to provide information on their computer recipe adjustment method and to recommend a foodservice director, currently using their software to represent them in this project. A follow-up letter (Appendix C) was mailed to the companies thanking them for their participation along with a request for a more detailed description of their recipe adjustment method.

Foodservice director participation

Foodservice directors were contacted by phone using a prepared statement (Appendix D) and asked to participate in the project using their computer software to adjust a home-size German chocolate cake recipe. Foodservice directors were then mailed a letter which contained a home-size recipe yielding 24 servings (Appendix E). To provide a standard, consistent starting point, ingredients from Baker's German chocolate home-size cake recipe were listed in both measures and weights. The measures were converted to weights using the conversion table in the book Food for Fifty (51). Foodservice directors were instructed to adjust the recipe to 60 and 540 servings using their computer program. If their computer program had the capability to adjust recipes in either weights or measures, then they were asked to adjust the recipe to each serving size twice, once in weights and once in measures. Also included with the recipe were an abstract of the research project and a questionnaire on production techniques (Appendix E). The questionnaire was to be completed by participants based on procedures used in their operation.

Follow-up letters (Appendix F) were sent three months later to participants who had not returned the adjusted computerized recipes and questionnaires. Duplicates of instructions for adjusting the home-size recipes and the questionnaire were included in the mailing. Participants who had not responded to the follow-up were contacted by phone.

Research Site

The study was conducted in the Department of Housing at Kansas State University, a land-grant university. The university is located in the midwest and has a total enrollment of approximately 18,000 students. The campus has three food centers which serve the eight residence halls housing approximately 3,800 students. Bakeries are located in two of the food centers, and bakery items are satellited to the third food center. The bakery at one of the food centers was used for preparation of cakes for the research project.

Panel Training

A sensory panel, comprised of eleven foodservice employees from Derby Food Center, was selected to evaluate the adjusted recipes. The panelists were asked to participate because of prior training in sensory analysis as part of a previous research project by Lee (42). Further in-depth training was designed in this project to familiarize members with test procedures, increase their ability to recognize the tested sensory characteristics and improve their sensitivity and memory to provide precise, consistent, and standardized sensory measurements.

The training sessions and tests were conducted on Wednesdays and Fridays from 1:30 PM to 1:45 PM in a dining room at Derby Food Center (Appendix G). The room was well lighted, comfortable, free of distractions and irrelevant odors. Panelists were spaced throughout the room at tables. To enhance concentration, panelists were discouraged from communicating with each other during sensory training and the actual testing.

Five training sessions were held over a two and half week period prior to the actual sensory testing. During the first session, panelists were introduced to the score card (Appendix H) which would be used to test the cake samples. An unstructured line scale, a descriptive test, was used on the score card to rate samples for crust color evenness, cell uniformity, cell size, density, and moistness of crumb. The line for the scale was six inches in length with descriptive terms at each end of the scale. Negative descriptive terms were used as anchors on the left end of the scale with positive terms on the right. Different cakes (Appendix H) were chosen by a food scientist and the researcher to demonstrate each opposing characteristic. Panelists were instructed to make a perpendicular line intersecting the line scale at a point that best described the tested sample. The perpendicular line was labeled with the random number assigned to the sample.

During the second session, the test procedure was reviewed and a sample of cake was evaluated. In the remaining three training sessions, the panelists tested a different kind of cake each week using the test procedures. These test results were evaluated by a food scientist and the researcher to compare the panelists' ability to score the tested sensory characteristics.

Procedure for Testing Recipes

Recipe preparation procedures

The adjusted computerized recipes were prepared by trained bakery personnel at Derby Food Center. All ingredients were measured at room temperature with the exception of egg whites, egg yolks, and buttermilk. Frozen egg whites and yolks were substituted for whole eggs because of their common use in quantity recipes.

The procedures for the German chocolate cake recipe had been tested and standardized for 60 servings by the researcher and the bakery supervisor (Appendix I). Each of the computer adjusted cake recipes for 60 servings received from participants was prepared three times. One recipe had an adjustment error for water which was corrected by the researcher when the recipe was prepared. All recipes were prepared in measures except for one recipe which had only been adjusted in weights. One additional recipe was selected to be made in both weights and measures for comparison to provide two cakes made in weights. The computer adjusted cake recipes for 60 servings were baked in a 12 × 18 × 2 inch pan. The home-size cake recipe for 24 servings, baked in three 9-inch rounds, was used as the standard. The six adjusted cake recipes and the home-size recipe were randomly selected to be evaluated on each day of testing. Three or four of the recipes were tested by the panel at one time, with testing completed in a period of three weeks (Appendix I).

Recipe testing procedures

Cake samples were cut one-inch from the side of the cake pan. Each panelist received a two-inch square of each sample, including the top crust. One six-inch square sample including the crust was taken from the same side of each cake. Each cake sample was placed on a wax paper square labeled with a random number and presented in a random order to panelists. Instructions were given to panelists to taste samples from left to right and to rinse his/her mouth with distilled water before tasting each sample. Panelists evaluated the six-inch sample from each cake for evenness of color.

Cakes were tested for volume by using the ACC10-91 Index to Volume developed by the American Association of Cereal Chemists. The cakes were marked at five points across the center of the cake (Appendix J). Wooden skewers were inserted into the cakes at these five points and were marked at the top of the cake. The marked skewers were then measured in centimeters.

Data Analysis

For a comparison, computer recipes adjusted in measurements were converted to common measures and recipes adjusted in weights were converted to ounces. Statistical analysis for significant differences in recipe ingredients was not possible because recipes were only adjusted one time.

Recipe ingredient ratios for fat to flour, liquid to flour, and sugar to flour were calculated and compared for differences in all recipes for 60 servings. Production questionnaire data were compared for differences in preparation procedures.

Volume measurements taken in centimeters at five points across the center of cakes were compared for an overall significant difference between recipes. Volume measurements were also analyzed for significant differences between the cakes prepared with weights and cakes prepared with measurements.

Sensory panel ratings by recipe for textural characteristics were analyzed for overall significant difference between recipes. Significant differences were also analyzed for recipes prepared with measurements and recipes prepared with weights. Sensory ratings for textural characteristics by panelist were analyzed for overall significant difference between panelists.

RESULTS AND DISCUSSION

The initial study sample consisted of six foodservice computer software companies. During the research project, one company declined to participate and was dropped from the study. Each computer software company and the recipes adjusted with that company's software were assigned the same three-digit code number to ensure confidentality during the research process.

Different methods of recipe adjustment were used by the companies. Descriptions of recipe adjustment methods were received from four of the five companies (Table 1). Three companies used variations of the factor method and one company used the percentage method.

Table 1. Computer company recipe adjustment methods

company number	adjustment method
242[1]	———
337	factor
345	factor
442	factor
553	percentage

[1] Recipe adjustment method information was not received.

Comparison of Adjusted Cake Recipes

Participating foodservice directors were asked to adjust a home-size German chocolate cake recipe to 60 and 540 servings using their computer program. If their computer program had the capability to adjust recipes in either weights or measurements, they were asked to adjust the recipe to each serving size twice, once in weights and once in measurements. Three companies adjusted recipes in both weights and measurements. Recipe adjustments performed by the remaining two companies were one in weights and the other in measurements.

Recipes adjusted in measurements

Recipes adjusted in measurements contained in Appendix K varied in listed ingredient measures. For example, the same recipe ingredient may have been adjusted in cups in one recipe and quarts and gallons in another. For comparison, adjusted recipes were converted to common measurements (Tables 2-3). Statistical analysis for significant differences in recipe ingredients was not possible because recipes were only adjusted one time.

Differences were noted between computer recipes adjusted in measures for 60 and 540 servings. Recipe 553 ingredient quantities were largest in both 60 and 540 servings. The percentage method was used to adjust recipe 553, allowing for handling loss as described by McManis and Molt (15).

Factor methods were used to adjust recipes 337 and 345. Both recipes had similar ingredient quantities for 60 and 540 servings. Ingredients with slight differences in quantities between recipes were baking soda and salt in the 60 servings recipes and buttermilk, water, and margarine in the 540 servings recipes. Recipe 442A, adjusted by

Table 2. Ingredients in measures for German chocolate cake recipes adjusted for 60 servings

recipe no.	ingredients[1]										
	cake flour	baking soda	salt	sugar	German choc	butter-milk	vanilla	water	egg yolk	egg white	marga-rine
	(cup)	(tsp)	(tsp)	(cup)	(oz)	(cup)	(tsp)	(cup)	(each)	(each)	(cup)
242[2]	-	-	-	-	-	-	-	-	-	-	-
442A	5.8	2.3	2.3	4.6	9.3	2.3	2.3	.1	9.3	9.3	2.3
337	6.3	2.5	1.3	5.0	10.0	2.5	2.5	1.3	10.0	10.0	2.5
345	6.3	2.3	1.0	5.0	10.0	2.5	2.3	1.3	10.0	10.0	2.5
553	6.8	2.8	1.3	5.5	10.8	2.7	2.8	1.3	11.0	11.0	2.7

[1] Ingredient amounts converted to common measure for comparison.

[2] Recipe adjusted only in weights.

Table 3. Ingredients in measures for German chocolate cake recipes adjusted for 540 servings

recipe no.	ingredients[1]										
	cake flour	baking soda	salt	sugar	German choc	butter-milk	vanilla	water	egg yolk	egg white	marga-rine
	(cup)	(tsp)	(tsp)	(cup)	(oz)	(cup)	(tsp)	(cup)	(each)	(each)	(cup)
242[2]	-	-	-	-	-	-	-	-	-	-	-
442A	51.8	20.7	21.0	41.7	83.0	21.0	20.7	.1	83.3	83.3	21.0
337	56.3	22.5	11.3	45.0	90.0	22.7	22.5	11.3	90.0	90.0	22.7
345	56.3	22.5	11.3	45.0	90.0	22.5	22.5	11.2	90.0	90.0	22.5
553	61.0	24.0	12.0	49.0	97.5	24.0	24.0	12.3	98.0	98.0	24.0

[1] Ingredient amounts converted to common measure for comparison.

[2] Recipe adjusted only in weights.

the factor method, was consistently smallest in recipe ingredient quantities for 60 and 540 servings with the exception of salt. An adjustment error for water was found in recipe 442A for both 60 and 540 servings. The error was corrected to .58 pounds for 60 servings by the researcher before the recipe was prepared. The advantages of standardized recipes can be quickly lost with such errors in recipe adjustment (13). Software from computer company 243 did not adjust recipes in measures.

Recipes adjusted in weights

All the computer adjusted recipes in weights contained in Appendix L listed recipe ingredients in pounds and ounces. For comparison the adjusted recipe ingredients were converted to ounces (Tables 4-5). Statistical analysis for significant differences in recipe ingredients was not possible because recipes were only adjusted one time.

Differences were noted for recipes adjusted in weights for 60 and 540 servings. As with measures, recipe 553 was adjusted using the percentage method and had the largest recipe ingredient quantities in both 60 and 540 servings.

Factor methods were used to adjust recipes 242 and 337, which were similar in ingredient weights for both 60 and 540 servings. Slight differences were noted in ingredient weights between the recipes for baking soda, salt, vanilla, and egg white in the 60 serving recipe, and cake flour, baking soda, salt, vanilla, egg yolk and egg white in the 540 serving recipe. As in measures, recipe 442B

Table 4. Ingredients in weights for German chocolate cake recipes adjusted for 60 servings

recipe no.	ingredients[1]										
	cake flour	baking soda	salt	sugar	German choc	butter-milk	vanilla	water	egg yolk	egg white	marga-rine
	oz										
242	21.0	.4	.4	40.0	10.0	20.0	.4	10.0	6.8	8.8	20.0
337	21.0	.3	.3	40.0	10.0	20.0	.3	10.0	6.8	8.9	20.0
345[2]	-	-	-	-	-	-	-	-	-	-	-
442B	19.3	.3	.3	36.8	9.2	18.4	.5	9.2	6.2	8.1	18.4
553	22.3	-	-	42.3	10.5	21.3	-	10.5	-	-	21.3

[1] Ingredient amounts all converted to ounces for comparison.

[2] Recipe adjusted only in measures.

Table 5. Ingredients in weights for German chocolate cake recipes adjusted for 540 servings

recipe no.	ingredients[1]										
	cake flour	baking soda	salt	sugar	German choc	butter-milk	vanilla	water	egg yolk	egg white	marga-rine
	←————					oz					————→
242	191.0	3.6	3.6	360.0	90.0	180.0	3.6	90.0	61.0	79.0	180.0
337	189.0	3.3	2.5	360.0	90.0	180.0	3.7	90.0	61.3	80.0	180.0
345[2]	-	-	-	-	-	-	-	-	-	-	-
442B	173.9	2.9	2.3	331.2	82.8	165.6	4.1	82.8	55.9	72.5	165.6
553	200.8	-	-	382.3	95.5	191.3	-	95.5	-	-	191.3

---

[1] Ingredient amounts all converted to ounces for comparison.

[2] Recipe adjusted only in measures.

was adjusted using a factor method and was smallest in recipe ingredient quantities. Recipe 442A and 442B are from the same computer software company. Software from computer company 345 did not adjust recipes in weights.

Ratio of ingredients in adjusted recipes

Recipe ingredient ratios for fat to flour, liquid to flour, and sugar to flour were calculated for all recipes in 60 servings (Table 6). Ratios for recipe ingredients were the same for all the recipes in 60 servings except for recipe 242. Ratios for recipe 242 were smaller for fat/flour, sugar/flour and liquid/flour. Recipe 242 consistently fell in the center and this may have been caused by the ratio of ingredients to flour.

Table 6. Ingredient ratios for adjusted recipes for 60 servings

computer recipe no.	ingredient ratios		
	fat/flour	sugar/flour	liquid/flour[1]
	ratio		
242	0.94 : 1	1.88 : 1	1.41 : 1
337	0.95 : 1	1.90 : 1	1.42 : 1
345	0.95 : 1	1.90 : 1	1.42 : 1
442	0.95 : 1	1.90 : 1	1.42 : 1
553	0.95 : 1	1.90 : 1	1.42 : 1

[1] Buttermilk and water are combined for liquid weight for ratio.

Production Questionnaire

Production questionnaires covered information on production procedures and equipment which would be used if the German chocolate cake recipe was prepared in quantity in the foodservice director's operation. Production questionnaires were completed by four of five foodservice directors (Table 7). Four different temperatures, ranging from 300°F-370°F, would be used to bake the German chocolate cakes in quantity. Deck and convection ovens would be used for baking. Length of cooking time would vary from 20 minutes to 40 minutes depending on temperature or oven used. Two foodservices would use fresh eggs while frozen egg whites and yolks would be used by the other two foodservices. A variety of pan sizes would be used ranging from 9 inch round pans to an 18 inch by 26 inch pan.

Two foodservice directors regularly used their computer program to adjust recipes from home-size to larger quantities. Recipes were most commonly adjusted to produce yields from 40 to 120 servings. Foodservice directors indicated there would not be any changes in proportions of ingredients if the home-size cake were prepared in quantity. Procedural changes indicated for recipes made in quantity were ingredient substitutions, pan size alternatives, and adjustment of baking temperature and time. Recipes should be standardized for each particular foodservice operation as stated by Aldrich (8).

Volume Measurements of Cake Samples

Volume measurements of cake samples were taken in centimeters at five points across the center of the cakes. Table 8 shows the mean

Table 7. Data from responses on quantity preparation of German chocolate cake recipe

	n
oven temperature	
300°F	1
310°F	1
350°F	1
370°F	1
type of oven	
convection	3
deck	2
length of cooking time	
20-30 minutes	1
30 minutes	1
35 minutes	1
35-40 minutes	1
type of eggs	
fresh	2
frozen egg whites and yolks	2
size of cake pan	
9" round	1
10" round	1
12" × 20"	1
18" × 26"	1

Table 8. Mean volume measurements of German chocolate cakes

recipe no.	point of measurement					
	LO[1]	LI[2]	C[3]	RI[4]	RO[5]	Ave.[6]
	←		cm			→
recipes adjusted in weights:						
242	3.57	2.93	1.77	2.97	3.43	2.93
			**			
442B	2.93	3.07	2.77	3.30	3.17	3.04
recipes adjusted in measures:		***	***	***		***
442A	3.00	3.67	3.83	3.83	3.47	3.56
337	3.70	3.97	3.87	4.03	3.67	3.84
345	3.70	4.00	4.07	4.03	3.57	3.87
553	3.87	3.67	3.63	3.77	4.10	3.80
home-size recipe used as standard:						
369	3.67	3.97	4.03	3.80	3.67	3.83

** $p \leq .01$
*** $p \leq .001$

[1] Left outside measurement, $p \leq .05$, see Table 11 Appendix M for analysis by recipe.

[2] Left inside measurement, $p \leq .01$, see Table 12 Appendix M for analysis by recipe.

[3] Center measurement, $p \leq .001$, see Table 13 Appendix M for analysis by recipe.

[4] Right inside measurement, $p \leq .001$, see Table 14 Appendix M for analysis by recipe.

[5] Right outside measurement, N.S.

[6] Average measurements, $p \leq .001$, see Table 15 Appendix M for analysis by recipe.

volume measurements of the tested German chocolate cakes. Volume measurements for cakes indicated differences between computer recipes. For example, the center mean volume measurements ranged from 1.77 centimeters for recipe 242 to 4.07 centimeters for recipe 345.

Overall a significant difference was noted between recipes in left outside, left inside, center, right inside, and average measurement points (Tables 11-15 Appendix M). Significant differences were also indicated between cakes prepared with weights and cakes prepared with measures in left inside, center, right inside, and average measurements. Recipes in weights were also significantly different in center volume measures.

Cakes prepared with weights had lower center volume measurements than those prepared with measures. Cake recipe 242 consistently fell in the center. A possible explanation for this may have been the conversion weight used for the cake flour in the home-size recipe. The weight per cup for cake flour may have been too small. When the recipe was adjusted to 60 servings, the amount of flour may not have been adequate for structure. The home-size recipe was prepared using weight conversions; however the cake did not fall in the center at this quantity size.

Recipe 442B prepared in weights also had low volume measurements each time it was prepared. When the recipe was adjusted, the ingredient weights were consistently less than other recipes. It may be assumed the low volumes of recipes 242 and 442B did not occur because the cakes were prepared in weights. The reasons may have been the original conversion weight used for flour in recipe 242 may have been too small, causing the cake to fall and the smaller quantities of adjusted recipe ingredients for recipe 442B may have caused the cake to have low volume.

Sensory Evaluations

An eleven member sensory panel was used to test selected textural characteristics of the German chocolate cakes. An unstructured line scale, a descriptive test, was used on the score card to test samples for crust color evenness, cell uniformity, cell size, density, and moistness of crumb. Three panel members ratings were eliminated from analysis of data because they had not tested three cake recipes.

Sensory rating by recipe

Table 9 shows mean sensory ratings for textural characteristics of German chocolate cakes. Overall significant differences between the recipes were indicated for crust color evenness and moistness of crumb (Tables 16-17 Appendix N). The recipe used as the standard was significantly different from the recipes prepared with measures for crust color evenness and the recipes prepared with weights for moistness of crumb.

Significant differences were also noted between recipes prepared with weights and measures for crust color evenness and moistness of crumb. This difference may have resulted from the low volume of cakes prepared with weights. Cake recipe 242, which consistently fell, had the highest mean rating for moistness of crumb and the lowest mean

Table 9. Mean sensory ratings for textural characteristics of German chocolate cake

recipe no.	textural characteristics				
	cr even[1]	cell uni[2]	cell size[3]	density[4]	moist[5]
	mean rating				
recipes adjusted in weights:					
242	3.9	8.1	9.2	8.8	11.2
442B	5.0	10.0	9.7	10.3	10.8
recipes adjusted in measures:					
442A	10.9	8.6	8.2	8.4	7.7
337	7.7	8.6	8.7	8.5	8.4
345	8.4	7.8	6.8	7.0	7.0
553	10.1	8.8	7.6	8.2	8.3
home-size recipe used as standard:					
369	5.1	8.3	7.7	9.1	8.9

* $p \leq .05$
** $p \leq .01$

[1] Crust color evenness, scale 0, uneven to 15, even, $p \leq .001$, see Table 16 Appendix N for analysis by recipe.

[2] Cell uniformity, scale 0, uneven to 15, even, N.S.

[3] Scale 0, very small to 15, very large, N.S.

[4] Scale 0, not dense to 15, very dense, N.S.

[5] Moistness of crumb, scale 0, very dry to 15, very moist, $p \leq .01$, see Table 17 Appendix N for analysis by recipe.

rating for crust color evenness. The two mean sensory ratings may have resulted from the low volume of the cake.

Sensory ratings by panelist

Table 10 shows mean panelist ratings for sensory textural characteristics. Overall a significant difference was found between individual panelists in their ratings of crust color evenness, cell uniformity, and moistness of crumb (Tables 18-20 Appendix O). Panelists were inconsistent in the sensory evaluations of the cakes for these textural characteristics. Specifically, panelist 3 was significantly different than other panelists in crust color evenness. Because of the significant differences found between the panelists, additional training may have been needed for these textural characteristics.

An overall significance was not shown between panelists' ratings for cell size and density. These characteristics were more consistently evaluated by panelists. Cell size and density may have been more consistently evaluated due to similarities in the sensory characteristics, better sensory training for these characteristics, or easier identification for panelists.

Table 10. Mean panelist ratings for sensory textural characteristics

panel member	cr even[1]	cell uni[2]	cell size[3]	density[4]	moist[5]
	mean rating				
1	7.3	8.3	9.3	8.8	8.3
2	7.6	8.4	8.9	9.1	9.6
3	3.8	7.3	7.1	7.9	8.2
4	9.4	10.3	8.1	7.6	10.5
5	5.6	6.3	8.0	8.7	10.2
6	8.3	9.6	8.4	9.5	8.8
7	7.2	8.3	8.3	7.5	7.2
8	9.1	9.7	8.3	9.6	9.7

[1] Crust color evenness, scale 0, uneven to 15, even, $p \leq .001$, see Table 18 Appendix O for analysis by panelist.

[2] Cell uniformity, scale 0, uneven to 15, even, $p \leq .01$, see Table 19 Appendix O for analysis by panelist.

[3] Scale 0, very large to 15, very small, N.S.

[4] Scale 0, not dense to 15, very dense, N.S.

[5] Moistness of crumb, scale 0, very dry to 15, very moist, $p \leq .01$, see Table 20 Appendix O for analysis by panelist.

SUMMARY AND CONCLUSIONS

Standardized recipes are the basis for computerized production systems. The purpose of this research project was to determine if differences exist in the recipe adjustment procedures of computer software companies as assessed by analytical and sensory recipe evaluations. Adjusted cake recipes were compared for differences in ingredient quantities, volume measures, and sensory evaluations using computer recipes adjusted to 60 servings.

The study sample originally consisted of six computer foodservice software companies. One of the companies decided not to participate and was dropped from the study. A foodservice director using software of each company was asked to adjust a home-size German chocolate recipe to 60 and 540 servings using their computer program. If their computer program had the capability to adjust recipes in either weights or measures, directors were asked to adjust the recipe to each serving size twice, once in weights and once in measures. Foodservice directors also completed a production questionnaire based on procedures they would use if the recipe were prepared in quantity in their operation.

Computer recipes adjusted to 60 servings were prepared using standardized procedures by trained bakery personnel. Prepared cake samples were evaluated by a trained sensory panel. An unstructured line scale was used on the score card to test cake samples for crust color evenness, cell uniformity, cell size, density, and moistness of crumb. Cake volumes were also recorded using the ACC10-91 Index to Volume.

Recipe adjustment procedure information received from four of five computer companies indicated that different adjustment methods were used. Three companies used various factor methods while the percentage method was used by the fourth company.

Computer recipes adjusted in measurements varied in ingredient measurements listed. Differences were noted between adjusted computer recipes for 60 and 540 servings. Recipes adjusted with percentage method consistently had larger ingredient quantities. Recipes adjusted with various factor methods differed in adjusted ingredient amounts.

Companies which adjusted recipes in weights gave ingredient amounts in pounds and ounces. Differences were also noted between adjusted recipes in 60 and 540 servings. As with measures, computer recipes adjusted with the percentage method consistently had larger ingredient quantities. Recipes adjusted with various factor methods differed between adjusted ingredients. Ingredient ratios calculated for fat to flour, liquid to flour, and sugar to flour were similar for all recipes in 60 servings except for one recipe. The smaller ingredient ratios may have caused this cake to fall in the center.

Production questionnaires completed by the foodservice directors indicated a variety of responses for production procedures, which would be used in their operation to prepare German chocolate cake recipes in quantity. Procedural changes indicated by foodservice directors were ingredient substitutions, pan size alterations, and baking temperature and time adjustments.

Volume measurements for cakes indicated differences between computer recipes. Overall a significant difference was noted between recipes in left outside, left inside, center, right inside, and average measurement points. Significant differences were also indicated between cakes prepared with weights and cakes prepared with measures in the left inside, center, right inside, and center measurements.

Cakes prepared using weights had lower volume means than those prepared with measures. It is assumed that the low volume of the cakes did not occur because cakes were prepared with weights. An initial ingredient conversion changing weight to measurements, may have been too small causing one cake to fall in the center. In the other recipe, ingredient weights were consistently smallest causing the product to have low volume.

Sensory panel ratings for cakes prepared from computer recipes indicated an overall significant difference between recipes in crust color evenness and moistness of crumb. Significant differences were also noted between recipes prepared with weights and recipes prepared with measures.

Significant differences were also indicated between panelists' ratings of crust color evenness, cell uniformity, and moistness of crumb. Because of these differences panelists may have needed additional training in these specific areas.

Methods of recipe adjustment differed between computer software company. Differences were noted in adjusted computerized recipe ingredients as well as significant differences in volume measurements, and sensory evaluations of the prepared cakes.

Results of this study suggest when selecting computer recipe software, it may be important to analyze recipe format, and type of recipe adjustment method used. The recipe adjustment method used appears to impact on the final prepared product. Foodservice directors searching for software need to question computer company sales representatives about recipe adjustment programming. Computer software companies should make adjustment procedure information available to prospective buyers or current users of their product.

Additional research is needed in comparing the precise mathematical formulas used to adjust the computerized recipes. Factor methods used to adjust recipes varied in mathematical formulas, as noted in the differences between the adjusted ingredients.

REFERENCES

(1) MacFarlane, A.M.: Standardized recipe system works. Institutions 44:28, 1959.

(2) Sager, J.F., and Ostenso, G.L.: Computerized recipe adjustment and food ordering. J Am Diet Assoc 52:498, 1968.

(3) Manchester, K., and Sager, J.F.: The proposed army hospital food service data processing system. J Am Diet Assoc 56:114, 1970.

(4) Paul, P., and Palmer, H.: Food Theory and Applications. New York: John Wiley & Sons, Inc., 1972, p. 20.

(5) Janssen, P.: Recipe construction. J Am Diet Assoc 29:125, 1953.

(6) Aldrich, P.: Quality food means more than recipes. J Am Diet Assoc 29:1089, 1955.

(7) Cranmore, M.: Mechanics of standardizing quantity recipes. Institutions 34:166, 1955.

(8) Aldrich, P.: Tailor-made recipes for modern food service. J Am Diet Assoc 31:898, 1955.

(9) Caleva, H.: Positive way to profit through formula cooking. Institutions 36:6, 1955.

(10) Janssen, P.: Up-to-date recipes. J Am Diet Assoc 34:134, 1958.

(11) Aldrich, P.: Reap rewards of controlled food production. Institutions 39:23, 1956.

(12) Aldrich, P., and Callahan, J.: New method of calculating yield of recipes. J Am Diet Assoc 35:45, 1959.

(13) Callahan, J.: Recipe expansion made easy. Institutions 46:10, 1960.

(14) West, B.B., Wood, L., Harger, V., and Shugart, G.S.: Food Service in Institutions. 5th ed. New York: John Wiley & Sons, 1977.

(15) McManis, H., and Molt, M.: Recipe standardization and percentage method of adjustment. NACUFS J, 1978, p. 35.

(16) Ostenso, G.L.: Evaluation of computer-assisted management of the dietary department. Hospitals 43(Nov.):94, 1969.

(17) Hoover, L.W.: Computers in dietetics: State-of-the-art, 1976. J Am Diet Assoc 68:39, 1976.

(18) Wilcox, M.M., Moore, A.N., and Hoover, L.W.: Automated purchasing: forecasts to determine stock levels and print orders. J Am Diet Assoc 73:400, 1978.

(19) Moe, G., Hoover, L.W., and Moore, A.N.: Part II: A computer-assisted personnel data system for a hospital department of dietetics. J Am Diet Assoc 74:454, 1979.

(20) Shick, G.L., Hoover, L.W., and Moore, A.N.: Part I: A computer-assisted personnel data system for a hospital department of dietetics. J Am Diet Assoc 74:449, 1979.

(21) Fromm, B., Moore, A.N., and Hoover, L.W.: Computer-generated fiscal reports for food cost accounting. J Am Diet Assoc 77:171, 1980.

(22) Guley, H.M., and Stinson, J.P.: Computer simulation for production scheduling in a ready foods system. J Am Diet Assoc 76:482, 1980.

(23) Lambert, C.V., and Beach, B.L.: Computerized scheduling for cook/freeze food production plans. J Am Diet Assoc 77:174, 1980.

(24) Youngwirth, J.: The evolution of computers in dietetics: A review. J Am Diet Assoc 82:62, 1983.

(25) Hiemstra, S., and VanEgmond-Pannell, D.: Computer applications in school food service. School Food Ser Res Rev 8(2):86, 1984.

(26) McCool, A., and Garand, M.: Computer technology in institutional foodservice. J Am Diet Assoc 86:48, 1986.

(27) Brown, R.: Computer-assisted cost accounting in the dietary department. Hospitals 43(Oct.):99, 1969.

(28) Ostenso, G.L.: Concepts of food systems management. In Moore, A.N., and Tuthill, B.H., eds.: Computer-Assisted Management Systems. Columbia, MO: Technical Education Services, 1971.

(29) Andrews, J.T.: Development of a standardized recipe data file for computer systems. In Moore, A.N., and Tuthill, B.H., eds.: Computer-Assisted Food Management Systems. Columbia, MO: Technical Education Services, 1971.

(30) Sager, J.F.: Recipe and ingredient control by computer. J Am Diet Assoc 43:87, 1969.

(31) Sager, J.F.: The United States Army Hospital food service data processing system. In Moore, A.N., and Tuthill, B.H., eds.: Computer-Assisted Food Management Systems. Columbia, MO: Technical Education Services, 1971, p. 75.

(32) Kaylin, B.A.: Development of a recipe procedure file for computer-adjusted recipes. Part 1: Master preparation procedure syllabus. Unpublished Technical Paper, University of Missouri-Columbia, 1971.

(33) Conklin, M.A.: Development of a recipe procedure file for computer-adjusted recipes. Part II: Coding form for recipe procedure file and design of adjusted recipe format. Unpublished Technical Paper, University of Missouri-Columbia, 1971.

(34) Torrence, B.L.: Development of data bases and recipe adjustment by percentage method using electronic data processing in a college residence hall foodservice system. Unpublished M.S. Thesis, Kansas State University, 1975.

(35) Torrence, B.L., and Vaden, A.G.: Recipe adjustment by percentage method in a college foodservice system. J Am Diet Assoc 69:407, 1976.

(36) Tuthill, B.H.: Computer-assisted food management system at the Medical Center, UMC. In Moore, A.N., and Tuthill, B.H., eds.: Computer-Assisted Food Management Systems. Columbia, MO: Technical Education Services, 1971, p. 86.

(37) Larmond, E.: Physical requirements for sensory testing. Food Technol 28(Nov.):28, 1973.

(38) Sensory evaluation guide for testing food and beverage products. Food Technol 35(Nov.):50, 1981.

(39) Spears, M.C., and Vaden, A.G.: Foodservice Organizations A Managerial and Systems Approach. New York: John Wiley & Sons, Inc., 1985.

(40) Jacobi, G.M., and Setser, C.: Effects of holding time and temperature on sensory quantity and thiamin content of spaghetti with meat sauce using foodservice and household preparation methods. School Food Serv Res Rev 9:25, 1985.

(41) Riley, D.M., Gregoire, M.B., and Setser, C.S.: Evaluation of three school foodservice systems: Student and expert sensory panel ratings, plate waste and time-temperature data. School Food Serv Res Rev 10(2):109, 1986.

(42) Lee, J.H.: Development of a course to teach basic concepts of sensory evaluation to foodservice personnel. Unpublished M.S. Report, Kansas State University, 1987.

(43) Manual on Sensory Testing Methods. Philadelphia: American Society for Testing and Materials, Publ. No. STP 434, 1968.

(44) Jellinek, G.: Sensory Evaluation of Food: Theory and Practice. Chichester, England: Ellis Horwood, 1985.

(45) Erhardt, J.P.: The role of the sensory analyst in product development. Food Technol 32(Nov.):57, 1978.

(46) Civille, G.V.: Case studies demonstrating the role of sensory evaluation in product development. Food Technol 32(Nov.):59, 1978.

(47) Guidelines for the Selection and Training of Sensory Panel Members. Philadelphia: American Society for Testing and Materials, Publ. No. STP 758, 1981.

(48) Skeleton, M.: Sensory evaluation of food. Cornell Hotel Restaur Admin Q 24(Feb.):51, 1984.

(49) Pangborn, R.M.: Sensory techniques of food analysis. In Gruenwedel, D.V., and Whitaker, J.R., eds.: Food Analysis: Principles and Techniques 1. New York: Marcel Dekker, Inc., 1984.

(50) Gacula, M.C., and Washam, R.W.: Scaling word anchors for measuring off flavor. J Food Quality 9:57, 1986.

(51) Shugart, G.S., Molt, M., and Wilson, M.: Food for Fifty. 7th ed. New York: John Wiley & Sons, Inc., 1984.

APPENDIXES

APPENDIX A

Computer Software Companies

Computer Company List

CBORD Group, Inc.
Suite 300 First Bank Building
Ithaca, NY 14850
(607) 272-2410

ComCater International, Inc.
194 Tamarack Circle
Skillman, NJ 08558
(609) 683-5146

Computrition, Inc.
21049 Devonshire St.
Catsworth, CA 91311
(818) 314-9739

Dynatran (Cook-Ware System)
5150 S.W. Griffith Drive
Beaverton, OR 97005
(800) 423-7650

Micro Foodcare System
1324 Sharingbrook Drive
Manhattan, KS 66502
(913) 539-1733

Practorcare, Inc.
10951 Sorrento Valley Road
Suite 2F
San Diego, CA 92121
(619) 450-0553

APPENDIX B

Company Representative Telephone Interview Form

Name of Company: ____________________

Address: ____________________

Phone: ____________________

Customer Service Representative: ____________________

Program Name: ____________________

Hello, my name is Sharon Tye. I am a registered dietitian and I work for the Kansas State University Residence Hall Foodservice. I am also a graduate student and I am interested in research involving computer software. Would you have a few minutes now that I could talk to you about your software program?

1) First of all, I am interested in knowing if recipe adjustment is included in your software package? ____________________

2) I am planning a research project that involves using computer software programs to adjust recipes. I would like to contact a foodservice director who uses your software program to ask, if she or he would be willing to adjust a home size recipe to quantity size? If the director agrees to participate in the project, I will send her a home size German chocolate cake recipe and ask her to adjust the recipe to 60 servings. This German chocolate cake recipe will be adjusted by several different software programs to see if the amounts of ingredients are the same in these adjusted recipes. Cakes from adjusted recipes will then be prepared using a standardized procedure. A trained panel will then be used to determine if the prepared cakes are the same or if there are

differences between the cakes in volume, texture, evenness of grain, mouth feel, and evenness of crust's color.

1) I would like to know if your company would be willing to participate in this research project by giving approval for the use of their computer program for adjusting recipes? ____________________

____

____

2) Do you think there would be an objection to identifying your company's software with the cake prepared from their adjusted recipe or would they like to remain ananymous? ____________________

____

____

3.a) Would you be able to provide me with the name of a foodservice director I could ask to adjust the recipe? ______________________

3.b) Could you give me that name and telephone number now or should I call back later? ____

I would like to ask you a few more questions about how your computer program adjusts recipes.

1) Does your computer program recipe input ingredients in weights or measures or both? ____

____

2) [If weights] - How does the computer program handle very small weights? Do measurements remain in weights or does the computer print terms such as "to taste," "trace," or something similar?

____

3.a) [If measurements] - How does the computer program enlarge a recipe? Will it change, for instance, teaspoons to tablespoons, tablespoons to cups, or will the measurement remain in the original measurement size? ____

3.b) How does the computer program handle very small measurements? Are the measurements printed in terms such as "to taste," "trace," or something similar? ______________________________

4) How does your computer program adjust a 12 serving cake to a 60 serving one? ____

____

____

Thank you for your time and information. Your company will be receiving a summary of my research. Thank you again for participating in my project.

APPENDIX C

Letter to Companies

(Letterhead)

August 23, 1986

To:

From: Sharon A. Tye, R.D.
Graduate Student

Mary B. Gregoire, Ph.D., R.D.
Assistant Professor

Thank you for your interest in participating in the research project on computerized recipe adjustment being conducted at Kansas State University. The information I received from you regarding your computer software program will be important to the success of the research project.

You indicated in our recent telephone conversation that your recipes are adjusted using a formula method. Would you be able to send me a more detailed description of how this method actually works in your program? A self addressed stamped envelope is enclosed for your response. The information on recipe adjustment will be included in the research summary.

Thank you again for your time and participation in the research project. Your company will receive a summary of the research results when the project is completed.

Enclosure

APPENDIX D

Foodservice Director Telephone Interview Form

Hello, my name is Sharon Tye. I am a registered dietitian and am working on a master's degree at Kansas State University. ____________________ a customer representative from ____________________ gave me your name as one of their software customers. I am working on a research project that involves computer software. Do you have a few minutes now that I could talk to you about the research project?

The research project involves using computer software programs to adjust recipes. I am contacting several foodservice directors such as yourself who use computer software programs to ask if they would be willing to adjust a home-size recipe to quantity size? If you agree to participate in the project, I will send you a home-size German chocolate recipe and ask you to adjust the recipe to 60 and 540 servings using your computer system. The same recipe will be adjusted by several different computer programs. The recipes will be compared to see if the amounts of ingredients are the same in these adjusted recipes. Cakes from adjusted recipes will be prepared using a standardized procedure. A trained panel will be used to determine if the prepared cakes are the same or if there are differences between the cakes in volume, texture, evenness of grain, mouth feel, and evenness of the crust's color.

Would you be willing to use your computer system to adjust a recipe for the research project? ____________________

In the next week I will be sending you a home-size recipe for German chocolate cake. Could I please clarify your address?

Name of Foodservice: ____________________
Address: ____________________
Foodservice Representative: ____________________

Thank you I really appreciate your time and interest in the research project. I will send you a copy of the research results when the project is finished.

I will be sending you a home-size recipe for German chocolate cake to adjust to 60 and 540 servings. The recipe will be in measures and weights so that you may enter the ingredient information as you normally do your recipes.

Thank you for your time and interest in my research project. Your foodservice will be receiving a copy of my research results.

APPENDIX E

Letter to Foodservice Directors with Home-Size Recipe, Questionnaire, and Abstract

(Letterhead)

August 30, 1986

Dear

Thank you for your interest in participating in the research project on computerized recipe adjustment being conducted at Kansas State University. The recipe adjustment performed using your computer program will be important to the success of the research project.

A home-size recipe for German chocolate cake is enclosed with ingredients given in weights and measures. We ask that you use your computer to adjust the recipe to 60 and 540 servings. If your computer has the capability to adjust recipes in either weights or measures, we ask that you adjust the recipe to each serving size twice, once in weights and once in measures.

The enclosed gold questionnaire requests information on preparation techniques. Please attach the questionnaire to the adjusted recipes and return in the self-addressed stamped envelope.

We appreciate your willingness to adjust this recipe and answer the questionnaire. Data from the study will be reported in summary form only. Individual institutions' names will not be published with the data. If you have any questions, please call Sharon Tye at (913) 532-6483.

A copy of the abstract for the research project has been included for your information. Your foodservice will receive a summary of the research results when the project is completed. Thank you again for your time and participation in the research project.

Sincerely,

Sharon Tye, R.D. Graduate Student	Mary B. Gregoire, Ph.D., R.D. Assistant Professor

Enclosures

KANSAS STATE UNIVERSITY

Department of Dietetics, Restaurant and Institutional Management

Evaluation of Computerized Recipe Adjustment

Instructions:

Please adjust the following recipe to 60 and 540 servings using your computer program. If your computer program has the capability to adjust recipes in either weights or measures, we ask that you adjust the recipe to each serving size twice, once in weights and once in measures.

GERMAN SWEET CHOCOLATE CAKE*

Number of servings: 24 (3 - 9 in. layers)
Weight per serving: .15

Ingredients	Measures	Weights
German Sweet Chocolate	4 oz. package	.25 LBS
Boiling Water	1/2 Cup	.25 LBS
Margarine	1 Cup	.5 LBS
Sugar	2 Cups	1.0 LBS
Egg Yolks	4	.17 LBS
Vanilla	1 tsp.	.01 LBS
Cake Flour	2 1/2 Cups	.525 LBS
Salt	1/2 tsp.	.007 LBS
Buttermilk	1 Cup	.5 LBS
Egg Whites	4	.222 LBS
Baking Soda	1 tsp.	.009 LBS

Procedure:

Melt chocolate in boiling water. Cool. Cream butter and sugar until fluffy. Add yolks, one at a time, beating well after each. Blend in vanilla and chocolate. Sift flour with soda and salt; add alternately with buttermilk to chocolate mixture, beating after each addition until smooth. Fold in beaten whites. Pour into three 9-inch layer pans, lined on bottoms with paper. Bake at 350°F for 30 to 35 minutes. Cool. Frost tops only.

*The recipe is copied from the four ounce package of Baker's German's Sweet Chocolate.

KANSAS STATE UNIVERSITY

Department of Dietetics, Restaurant and Institutional Management

Evaluation of Computerized Recipe Adjustment

Recipe procedures play an important role in adjusting home-size recipes to quantity size. The procedures for the German chocolate cake home-size recipe are as follows:

> Melt chocolate in boiling water. Cool. Cream butter and sugar until fluffy. Add yolks, one at a time, beating well after each. Blend in vanilla and chocolate. Sift flour with soda and salt; add alternately with buttermilk to chocolate mixture, beating after each addition until smooth. Fold in beaten whites. Pour into three 9-inch layer pans, lined on bottoms with paper. Bake at 350°F for 30 to 35 minutes. Cool. Frost tops only.

Procedure Information:

Please answer the following questions based on procedures which would be used if someone in your operation were to prepare the cake in quantity.

1. What temperature would be used to bake the cake?

   ____

2. What type of an oven would be used?

   ____ convection
   ____ deck oven
   ____ reel or rotary oven
   ____ other, please describe

   ____

3. What length of time would the cake be baked?

   ____________ minutes

4. What type of eggs would be used?

   ____ Fresh
   ____ Frozen Egg Whites and Yolks

5. What size of cake pan would be used?

   ____ 9" round
   ____ 9" × 13"
   ____ 12" × 20" (counter pan)
   ____ 18" × 26" (baking sheet)
   ____ other, please describe

   ____

6. Have you used your computer system to expand home-size recipes for cakes to a larger quantity?

   ____ yes
   ____ no

7. If you have expanded home-size cake recipes, to what number of servings do you usually expand to?

   ____

Please turn over to complete

8. If you were to prepare the computer adjusted recipe for German chocolate cake in 60 or 540 servings, would there be any changes you would make in amounts of ingredients? If so, please describe.

9. If you were to prepare the computer adjusted recipe for German chocolate cake in 60 or 540 servings, would you make any changes in the procedures for the recipe? If so, please describe.

Thank you for completing the questionnaire.

Please attach it to the adjusted recipes.

KANSAS STATE UNIVERSITY

Department of Dietetics, Restaurant and Institutional Management

Evaluation of Computerized Recipe Adjustment

ABSTRACT

Standardized recipes are an integral part of a successful foodservice operation. Computerization has provided foodservice managers with a quick and easy means for rapidly adjusting recipes. Computer-assisted recipe adjustment increases the efficiency and effectiveness of the total operation by facilitating improved production control.

This research project is designed to determine if differences exist in recipe adjustment procedures used by various computer software companies and to assess the impact of such differences on sensory characteristics of the prepared food product. Six computer software companies will be contacted to obtain information on their program for recipe adjustment and to solicit names of foodservice directors using their software. Those foodservice directors who agree to participate will be asked to use their computer to adjust a home-size German chocolate cake recipe to 60 and 540 servings and to complete a questionnaire on preparation techniques.

Adjusted recipes will be compared using both analytical and sensory evaluations. An analysis of variance model will be used to examine differences in amounts of individual ingredients used in each recipe (i.e. flour, sugar, shortening etc.). Ratios for liquid to sugar, flour to sugar, and sugar to fat will be calculated for each recipe. The calculated ratios will be compared to published standards.

Cakes will be prepared from the recipes for 60 servings using a standardized procedure. A trained sensory panel will then be used to determine if the prepared cakes are the same or if there are differences between the cakes in volume, texture, evenness of grain, mouth feel, and evenness of crust's color.

APPENDIX F

Follow-up Letter to Foodservice Directors

(Letterhead)

January 2, 1987

Dear

In September, a letter was sent asking you to adjust a home-size recipe for German chocolate cake using your computer program. If you have already mailed your adjusted recipes to us, please disregard this letter. The recipe adjustment performed using your computer program will be important to the success of the research project.

In case you did not receive the mailing, let us briefly describe the study. A home-size recipe for German chocolate cake is enclosed with ingredients given in weights and measures. We ask that you use your computer to adjust the recipe to 60 and 540 servings. If your computer has the capability to adjust recipes in either weights or measures, we ask that you adjust the recipes to each serving size twice, once in weights and once in measures.

The enclosed gold questionnaire requests information on preparation techniques. Please attach the questionnaire to the adjusted recipes and return in the self-addressed, stamped envelope by January 19th.

Data from this study will be reported in summary form only. Individual institutions' names will not be published with the data. We appreciate your willingness to adjust this recipe and answer the questionnaire. If you have any questions, please call Sharon Tye at (913) 532-6484.

Sincerely,

Sharon Tye, R.D.
Graduate Student

Mary Gregoire, Ph.D., R.D.
Assistant Professor

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Enclosures

APPENDIX G

Sensory Panel Training and Testing Schedule

Sensory Panel Training and Testing Schedule

Training:

Date	Day	Time
Feb. 4	Wed.	1:30 p.m.
Feb. 6	Fri.	1:30 p.m.
Feb. 11	Wed.	1:30 p.m.
Feb. 13	Fri.	1:30 p.m.
Feb. 18	Wed.	1:30 p.m.

Testing:

Feb. 25	Wed.	1:30 p.m.
Feb. 27	Fri.	1:30 p.m.
March 4	Wed.	1:30 p.m.
March 6	Fri.	1:30 p.m.
March 11	Wed.	1:30 p.m.
March 13	Fri.	1:30 p.m.

APPENDIX H

Sensory Score Card and Cake Samples Selected for Training Panelists

Date: ____________________

Name: ____________________

Crust Color Evenness
Uneven Even
____

Cell Uniformity
Uneven Even
____

Cell Size
Very Large Very Small
____

Density
Not Dense, Open Very Dense, Close
____

Moistness of Crumb
Very Dry Very Moist
____

Comments:

Sensory Training Cake Samples

Crust Color Evenness

Uneven:
cakes with light and dark spots on the crust

Even:
cakes with uniform crust color

Cell Uniformity

Uneven:
cakes with irregular cell sizes

Even:
cakes with uniform cell sizes

Cell Size

Very Large:
angel food cake

Very Small:
German chocolate cake

Density

Not Dense, Open:
sponge cake

Very Dense, Close:
pound cake

Moistness of Crumb

Very Dry:
short cake

Very Moist:
chocolate torte

APPENDIX I

Standardized Recipe Procedures
and
Testing Schedule for Cakes

German Sweet Chocolate Cake

Equipment: Large and Small Mixer Bowls
Mixer
Flat Paddles - Whip
Stainless Steel Bowl
Greased Cake Pan
Steam Jacketed Kettle
350°F Oven

Portions: 60

Portion Size: .15 lb.

Recipe Source: Baker's German Sweet Chocolate

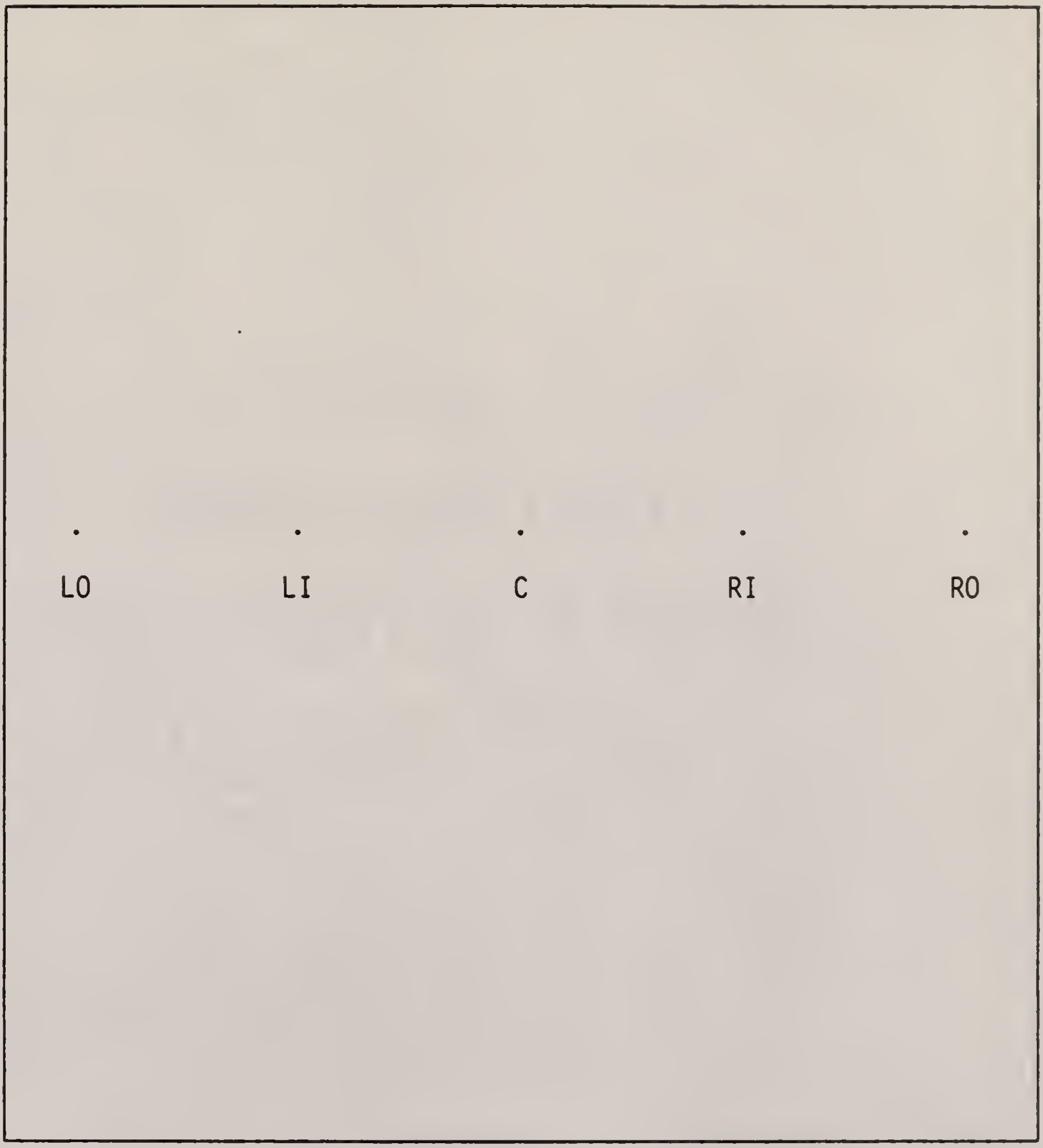
Ingredients	Weights and Measures	Procedures
German Sweet Chocolate Water		1. Add chocolate to water in stainless steel bowl. Place bowl over hot water in steam jacketed kettle (5 minutes to melt). Save for step 3.
Margarine Solids Sugar Egg Yolks		2. Cream together margarine, sugar, and yolks 10 minutes on No. 2 speed. Scrape down the sides of the mixing bowl.
Vanilla		3. Blend in vanilla. 4. Blend in chocolate slowly. 5. Mix 1 minute and scrape down sides. Mix ½ minute longer.
Cake Flour Baking Soda Salt		6. Combine dry ingredients in another mixer bowl on No. 1 speed for 1 minute.
Buttermilk		7. Add 1/3 buttermilk. Mix on No. 1 speed 1 minute. Add 1/3 dry ingredients. Mix 1 minute. Continue to alternate ingredients. Scrape down bowl. (8 minutes total)
Egg Whites		8. Beat egg whites on No. 3 speed approximately 3 minutes until stiff peaks form. 9. Fold stiffly beaten egg whites into chocolate mixture on No. 1 speed 1 minute. Scrape down bowl. Mix ½ minute on No. 1 speed. Finish mixing by hand. Do not over mix. 10. Scale into 18 × 26 × 2" cake pan. 11. Bake at 350°F for 35 minutes.

Testing Schedule for Cakes

Random #	Day
Week 1:	
345	(Wed)
242	(Fri)
442B	(Wed)
337	(Wed)
553	(Fri)
442B	(Fri)
369	(Fri)
Week 2:	
345	(Fri)
242	(Fri)
442B	(Fri)
337	(Wed)
553	(Wed)
442A	(Wed)
369	(Fri)
Week 3:	
345	(Fri)
242	(Wed)
442B	(Wed)
337	(Wed)
553	(Fri)
442A	(Fri)
369	(Fri)

APPENDIX J

Locations of Volume Measurements



Locations of Volume Measurements of
the Cakes for 60 Servings

APPENDIX K

Computer Recipes Adjusted in Measures

```
        UNIT:
        DATE: WEDNESDAY  01/20/87                                     Recipe 337
=============================================================================
1529  KS GERMAN SWEET CHOCOLATE CAKE                  YIELD    :     8.75 LB
-----------------------------------------------------------------------------
PORTIONS : 60      2.40 OZ           COOKING TIME :
PREP TIME:                           COOKING TEMP :
                                     COOKING UTEN :
                                     SERVING PAN  :
PREPARE MAIN BATCH  1 TIME(S)        SERVING UTEN :
-----------------------------------------------------------------------------
     INGREDIENT            ------- MAIN BATCH --------  ------ PARTIAL BATCH ------
                                   QUANTITY                       QUANTITY
-----------------------------------------------------------------------------
CHOCOLATE GRMN SWEET 4 OZ               2 1/2 PKG
WATER                                   1 1/4 CUP
MARGARINE                               2 1/2 CUP
SUGAR GRANULATED           1 QT         1     CUP
EGG YOLKS                              10     EACH
FLAVORING VANILLA                       2 1/2 TSP
FLOUR ALL PURPOSE X        1 QT         2 1/4 CUP
SALT                                    1 1/4 TSP
MILK BUTTERMILK QT                      2 1/2 CUP
EGG WHITES                             10     EACH
BAKING SODA                             2 1/2 TSP
   1.  MELT CHOCOLATE IN BOILING WATER.  COOL.
   2.  CREAM BUTTER AND SUGAR UNTIL FLUFFY.  ADD YOLKS, ONE AT A TIME,
         BEATING WELL AFTER EACH.  BLEND IN VANILLA AND CHOCOLATE.
   3.  SIFT FLOUR WITH SODA AND SALT; ADD ALTERNATELY WITH BUTTERMILK
         TO CHOCOLATE MIXTURE, BEATING AFTER EACH ADDITION UNTIL SMOOTH.
   4.  FOLD IN BEATEN WHITES.  POUR INTO THREE 9-INCH LAYER PANS,
         LINED ON BOTTOMS WITH PAPER.
   5.  BAKE AT 350 DEGREES FOR 30 TO 35 MINUTES. COOL.  FROST TOPS ONLY.
-----------------------------------------------------------------------------
```

```
                                                                              Recipe.345
INGREDIENTS for :        2.50 Basic YIELDS to be prepared               1 TIME
--------------------------------------------------------------------------------------
SCALED YIELD     :        60.00 EACH       # OF SERVINGS :            60
SERVING SIZE :     1.00 EACH
LN     ITEM.NAME                          AMT UNIT    AMT UNIT    AMT UNIT    AMT UNIT
--------------------------------------------------------------------------------------
1      GERMAN SWEET CHOCOLATE              10 OZ
2      WATER HOT                            1 CUP     1/4 CUP
3      BUTTER SWT                           2 CUP     1/2 CUP
4      SUGAR GRANULATED                     1 QT      1/4 QT
5      EGGS, WHOLE                         10 EACH
6      EXTRACT VANILLA                    3/4 TBS
7      FLOUR CAKE                           1 QT      1/2 QT      1/4 CUP
8      SALT TABLE                           1 TSP
9      BUTTERMILK GALLON                    2 CUP     1/2 CUP
10     BAKING SODA                        3/4 TBS
```

```
      R9999    GERMAN SWEET CHOC CAKE                      10/31/86 FRIDAY
               =========================                   prep area: BAKE
                                       actual
batch desc  :    1.00 SHEET           --------   producer: UNAS --------------------
batch wt    :     7 lb 15.00 oz
calc unit wt:           1.00 oz       --------   equip 1  :
std unit wt :     7 lb 15.00 oz                  equip 2  :
std c/recipe:         $4.36                      equip 3  :
====================================================================================
servings    :          60
svs desc    :     2.2   OZ                .15      LB
svs weight  :         2.11 oz
std c/svs   :       $0.07
====================================================================================
```

ingr		item identification	quantity	unit
1	A4716	CHOCOLATE GERMAN SWEET	9 1/4	OZ
2	A5098	WATER - BOILING	1/8	OZ
3	A1470	MARGARINE-30/1#	2 1/3	CUPS
4	A4640	SUGAR-WHITE GRAN 1/25#	4 5/8	CUPS
5	A1109	EGGS F~~RESH AA LARGE~~ 15 frozen whole	9 1/4	EA
6	A4744	EXTRACT-VANILLA REAL 1/	2 1/3	TSP
7	A4530	FLOUR CAKE	5 3/4	CUPS
8	A5385	SALT-IODIZED 24/26 OZ	2 1/3	TSP
9	A1005	MILK-BUTTERMILK 48/8 OZ	2 1/3	CUP
10	A1160	EGG WHITES FROZEN 6/5#	9 1/4	EACH
11	A4706	BAKING SODA 24/1#	2 1/3	TSP

Recipe 553

German Sweet Chocolate Cake

COOKING TIME: 30 - 35 minutes TEMPERATURE: 350 'F

PORTION 2.40 oz	24 SERVINGS	60 SERVINGS	540 SERVINGS
PAN SIZE:			
INGREDIENTS:			
chocolate German swt	4 1/4oz	10 3/4oz	6# 1 1/2oz
water boiling	1/2c 1T	1 1/3c	3qt 1/4c
margarine regular	1c 1T	2 2/3c 1T	1gal 2qt
sugar granulated	2c 3T	1qt 1 1/2c	3gal 1/4qt
egg raw yol fr	5 yol	11 yol	98 yol
extract vanilla	1t	2 3/4t	1/2c
flour cake	2 2/3c 1T	1qt 2 3/4c	3gal 3 1/4qt
salt	1/2t	1 1/4t	1/4c
soda	1t	2 3/4t	1/2c
bu milk fl	1c 1T	2 2/3c 1T	1gal 2qt
egg raw wht fr	5 wht	11 wht	98 wht

(HANDLING LOSS 3.0%)

```
INGREDIENTS for :       22.50 Basic YIELDS to be prepared               Recipe 345
------------------------------------------------------------------------------------
SCALED YIELD    :      540.00 EACH       # OF SERVINGS :         540
SERVING SIZE :    1.00 EACH
L#     ITEM.NAME                        AMT UNIT    AMT UNIT    AMT UNIT    AMT UNIT
------------------------------------------------------------------------------------
1      GERMAN SWEET CHOCOLATE             5 LB      1/2 LB        2 OZ
2      WATER HOT                        2/3 GAL     1/8 QT
3      BUTTER.SWT                         1 GAL     1/3 GAL     1/4 QT      1/6 CUP
4      SUGAR GRANULATED                   2 GAL     3/4 GAL     1/4 QT
5      EGGS, WHOLE                        7 DOZ       6 EACH
6      EXTRACT VANILLA                    7 TBS     1/2 TBS
7      FLOUR CAKE                         3 GAL     1/2 GAL     1/4 CUP
8      SALT TABLE                         3 TBS     3/4 TBS
9      BUTTERMILK GALLON                  1 GAL     1/3 GAL     1/4 QT      1/6 CUP
10     BAKING SODA                        7 TBS     1/2 TBS
```

```
         DATE: WEDNESDAY  01/28/87
============================================================================ Recipe 337
1529  KS GERMAN SWEET CHOCOLATE CAKE               YIELD     :     78.75 LB
---------------------------------------------------------------------------------------
PORTIONS : 540      2.40 OZ           COOKING TIME :
PREP TIME:                            COOKING TEMP :
                                      COOKING UTEN :
                                      SERVING PAN  :
PREPARE MAIN BATCH  1 TIME(S)         SERVING UTEN :
---------------------------------------------------------------------------------------
      INGREDIENT           ------- MAIN BATCH -------- ------ PARTIAL BATCH ------
                                    QUANTITY                      QUANTITY
---------------------------------------------------------------------------------------
CHOCOLATE GRMN SWEET 4 OZ               22 1/2 PKG
WATER                        2 QT        3 1/4 CUP
MARGARINE                    1 GAL       1 2/3 QT
SUGAR GRANULATED             2 GAL       3 1/4 QT
EGG YOLKS                               90     EACH
FLAVORING VANILLA                        7 1/2 TBSP
FLOUR ALL PURPOSE            3 GAL       2 1/16QT
SALT                                     3 3/4 TBSP
MILK BUTTERMILK QT           1 GAL       1 2/3 QT
EGG WHITES                              90     EACH
BAKING SODA                              7 1/2 TBSP
```

Recipe 442

```
      R9999   GERMAN SWEET CHOC CAKE                                 10/31/86 FRIDAY
              ==========================                             prep area: BAKE
                                     actual
batch desc  :   9.00 SHEET         --------  producer: UNAS ---------------------
batch wt    :   71 lb  4.00 oz
calc unit wt:           1.00 oz  --------  equip 1  :
std unit wt :    7 lb 15.00 oz               equip 2  :
std c/recipe:         $39.22                 equip 3  :
=================================================================================
servings    :             540
svs desc    :     2.2     OZ              .15      LB
svs weight  :            2.11 oz
std c/svs   :           $0.07
=================================================================================
 ingr          item identification                           quantity      unit
 ====   ==============================                      ===========   =====

   1     A4716   CHOCOLATE GERMAN SWEET                          82   3/4    OZ

   2     A5098   WATER - BOILING                                  1   1/8    OZ

   3     A1470   MARGARINE-30/1#                                 21          CUPS

   4     A4640   SUGAR-WHITE GRAN 1/25#                          41   2/3    CUPS
                         frozen whole
   5     A1109   EGGS FR~~ESH AA LARGE~~ 15                      83   1/4    EA

   6     A4744   EXTRACT-VANILLA REAL 1/                         20   2/3    TSP

   7     A4530   FLOUR CAKE                                      51   3/4    CUPS

   8     A5385   SALT-IODIZED 24/26 OZ                           21          TSP

   9     A1005   MILK-BUTTERMILK 48/8 OZ                         21          CUP

  10     A1160   EGG WHITES FROZEN 6/5#                          83   1/4    EACH

  11     A4706   BAKING SODA 24/1#                               20   2/3    TSP
```

APPENDIX L

Computer Recipes Adjusted in Weights

```
Name :GERMAN CHOCOLATE CAKE                  Cost  per Serving :$ 0.00
Size of Serving : 2.3  OZ                    Yield of Recipe :    8.6 LB
Number of Servings : 60
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Suggested Min/Max 24  /  600 )                      (Adv. PreparationN. A. )
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                    I N G R E D I E N T   I N F O R M A T I O N

Preparation          Ingredient                Quantity     Adv.        Adv.
   S t e p              Name                   Required     W-DRL.      Prep.
============         ==========                ========     =====       =====
      1        GERMAN CHOCOLATE                10.0 OZ      None        None
      1        BOILING WATER                   10.0 OZ      None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      2        MARGARINE                   1 LB   4 OZ      None        None
      2        SUGAR                       2 LB   8 OZ      None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      3        EGG YOLKS                        6.8 OZ      None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      4        VANILLA                          0.4 OZ      None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      5        CAKE FLOUR                  1 LB   5 OZ      None        None
      5        SALT                             0.4 OZ      None        None
      5        SODA                             0.4 OZ      None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      6        BUTTERMILK                  1 LB   4 OZ      None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      7        EGG WHITES                       8.8 OZ      None        None

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

```
         UNIT:
         DATE: WEDNESDAY  01/28/87
==========================================================================Recipe 337
1528  KS GERMAN SWEET CHOCOLATE CAKE                   YIELD     :      8.75 LB
-------------------------------------------------------------------------------
PORTIONS : 60      2.40 OZ               COOKING TIME  :
PREP TIME:                               COOKING TEMP  :
                                         COOKING UTEN  :
                                         SERVING PAN   :
PREPARE MAIN BATCH  1 TIME(S)            SERVING UTEN  :
-------------------------------------------------------------------------------
      INGREDIENT              ------- MAIN BATCH --------- ------ PARTIAL BATCH ------
                                        QUANTITY                     QUANTITY
-------------------------------------------------------------------------------
CHOCOLATE GERMAN SWEET                     10      OZ
WATER                                      10      OZ
MARGARINE                        1 LB       4      OZ
SUGAR GRANULATED                 2 LB       8      OZ
EGG YOLKS                                   6 3/4 OZ
FLAVORING VANILLA                             1/3 OZ
FLOUR ALL PURPOSE                1 LB       5      OZ
SALT                                          1/4 OZ
MILK BUTTERMILK QT               1 LB       4      OZ
EGG WHITES                                  8 7/8 OZ
BAKING SODA                                   1/3 OZ
```

Recipe 442

```
      R9999   GERMAN SWEET CHOC CAKE                          10/31/86 FRIDAY
              ========================                        prep area: BAKE
                                  actual
atch desc  :   1.00 SHEET       --------  producer: UNAS ---------------------
atch wt    :    7 lb 15.00 oz
alc unit wt:          1.00 oz   --------  equip 1  :
td unit wt :    7 lb 15.00 oz             equip 2  :
td c/recipe:         $4.36                equip 3  :
==============================================================================
ervings    :          60
vg desc    :    2.2   OZ             .15     LB
vg weight  :        2.11 oz
td c/svg   :       $0.07
==============================================================================
```

insr		item identification	lb	oz
1	A4716	CHOCOLATE GERMAN SWEET		9.200
2	A5098	WATER - BOILING		9.200
3	A1470	MARGARINE-30/1#	1	2.400
4	A4640	SUGAR-WHITE GRAN 1/25#	2	4.800
5	A1109	EGGS ~~FRESH-AA LARGE~~ frozen whole 15		6.210
6	A4744	EXTRACT-VANILLA REAL 1/		0.460
7	A4530	FLOUR CAKE	1	3.320
8	A5385	SALT-IODIZED 24/26 OZ		0.253
9	A1005	MILK-BUTTERMILK 48/8 OZ	1	2.400
10	A1160	EGG WHITES FROZEN 6/5#		8.050
11	A4706	BAKING SODA 24/1#		0.322

Recipe 553

German Sweet Chocolate Cake (Weight)

COOKING TIME: 30 - 35 minutes TEMPERATURE: 350 °F

PORTION 2.40 oz	24 SERVINGS	60 SERVINGS	540 SERVINGS
PAN SIZE:			
INGREDIENTS:			
chocolate German swt	4 1/4oz	10 1/2oz	5#15 1/2oz
water boiling	4 1/4oz	10 1/2oz	5#15 1/2oz
margarine regular	8 1/2oz	1# 5 1/4oz	11#15 1/4oz
sugar granulated	1# 1oz	2#10 1/2oz	23#14 1/4oz
egg raw yol fr	5 yol	11 yol	96 yol
extract vanilla	1t	2 3/4t	1/2c
flour cake	9oz	1# 6 1/4oz	12# 8 3/4oz
salt	1/2t	1 1/4t	1/4c
soda	1t	2 3/4t	1/2c
bu milk fl	8 1/2oz	1# 5 1/4oz	11#15 1/4oz
egg raw wht fr	5 wht	11 wht	96 wht

(HANDLING LOSS 3.0%)

Recipe 242

```
Name :GERMAN CHOCOLATE CAKE                 Cost per Serving :$ 0.00
Size of Serving : 2.3  OZ                   Yield of Recipe :   77.4 LB
Number of Servings : 540
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
(Suggested Min/Max 24  /  600 )                      (Adv. PreparationN. A. )
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                    I N G R E D I E N T   I N F O R M A T I O N

Preparation         Ingredient                 Quantity     Adv.        Adv.
  S t e p              Name                    Required     W-DRL.      Prep.
============        ==========                 ========     =====       =====
      1         GERMAN CHOCOLATE          5 LB   10 OZ     None        None
      1         BOILING WATER             5 LB   10 OZ     None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      2         MARGARINE                11 LB    4 OZ     None        None
      2         SUGAR                    22 LB    8 OZ     None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      3         EGG YOLKS                 3 LB   13 OZ     None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      4         VANILLA                         3.6 OZ     None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      5         CAKE FLOUR               11 LB   15 OZ     None        None
      5         SALT                            3.6 OZ     None        None
      5         SODA                            3.6 OZ     None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      6         BUTTERMILK               11 LB    4 OZ     None        None
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
      7         EGG WHITES                4 LB   15 OZ     None        None

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
```

```
                                                                                Recipe 337
     DATE: WEDNESDAY  01/28/97
==========================================================================================
:523  KS GERMAN SWEET CHOCOLATE CAKE                      YIELD      :     78.75 LB
------------------------------------------------------------------------------------------
PORTIONS : 540      2.40 OZ          COOKING TIME  :
PREP TIME:                           COOKING TEMP  :
                                     COOKING UTEN  :
                                     SERVING PAN   :
PREPARE MAIN BATCH   1 TIME(S)       SERVING UTEN  :
------------------------------------------------------------------------------------------
      INGREDIENT              ------- MAIN BATCH --------  ------ PARTIAL BATCH ------
                                      QUANTITY                     QUANTITY
------------------------------------------------------------------------------------------
CHOCOLATE GERMAN SWEET          5 LB       10       OZ
WATER                           5 LB       10       OZ
MARGARINE                      11 LB        4       OZ
SUGAR GRANULATED               22 LB        8       OZ
EGG YOLKS                       3 LB       13  1/4  OZ
FLAVORING VANILLA                           3  2/3  OZ
FLOUR ALL PURPOSE              11 LB       13       OZ
SALT                                        2  1/2  OZ
MILK BUTTERMILK QT             11 LB        4       OZ
EGG WHITES                                  5       LB
BAKING SODA                                 3  1/4  OZ
------------------------------------------------------------------------------------------
```

Recipe 442

```
       R9999    GERMAN SWEET CHOC CAKE                                   10/31/86 FRIDAY
                ======================                                   prep area: BAKE
                                      actual
batch desc  :    9.00 SHEET         --------   producer: UNAS ----------------------
batch wt    :    71 lb   4.00 oz
calc unit wt:            1.00 oz    --------   equip 1  :
std unit wt :     7 lb 15.00 oz                equip 2  :
std c/recipe:        $39.22                    equip 3  :
==========================================================================================
servings    :           540
svg desc    :     2.2    OZ               .15      LB
svg weight  :          2.11 oz
std c/svg   :        $0.07
==========================================================================================
 ingr        item identification               lb     oz
 ====   ===========================           ====  ======

   1    A4716   CHOCOLATE GERMAN SWEET           5    2.800

   2    A5098   WATER - BOILING                  5    2.800

   3    A1470   MARGARINE-30/1#                 10    5.600

   4    A4640   SUGAR-WHITE GRAN 1/25#          20   11.200
                      frozen whole
   5    A1109   EGGS ~~FRESH AA LARGE 15~~       3    7.890

   6    A4744   EXTRACT-VANILLA REAL 1/               4.140

   7    A4530   FLOUR CAKE                      10   13.880

   8    A5385   SALT-IODIZED 24/26 OZ                 2.277

   9    A1005   MILK-BUTTERMILK 48/8 OZ         10    5.600

  10    A1160   EGG WHITES FROZEN 6/5#           4    8.450

  11    A4706   BAKING SODA 24/1#                     2.898
```

APPENDIX M

Analysis of Differences in Mean Volume Measurement Points

Table 11. Analysis of differences in mean volume for left outside point of German chocolate cakes

recipe no.	mean volume	recipes						
		242	442A	337	348	369	442B	553
		← p value →						
242	3.57	.						
442A	3.00	0.068						
337	3.70	0.649	0.029					
345	3.70	0.649	0.029	1.000				
369	3.67	0.733	0.036	0.909	0.909			
442B	2.93	0.044	0.820	0.018	0.018	0.023		
553	3.87	0.313	0.009	0.570	0.570	0.497	0.006	.

Table 12. Analysis of differences in mean volume for left inside point of German chocolate cakes

recipe no.	mean volume	recipes						
		242	442A	337	348	369	442B	553
		← p value →						
242	2.93	.						
442A	3.67	0.020	.					
337	3.97	0.003	0.301	.				
345	4.00	0.002	0.253	0.907	.			
369	3.97	0.002	0.301	1.000	0.907	.		
442B	3.07	0.641	0.050	0.006	0.005	0.006	.	
553	3.67	0.020	1.000	0.301	0.253	0.301	0.050	.

Table 13. Analysis of differences in mean volume for center point of German chocolate cakes

recipe no.	mean volume	recipes						
		242	442A	337	345	369	442B	553
		← p value →						
242	1.77	.						
442A	3.83	0.001	.					
337	3.87	0.001	0.903	.				
345	4.07	0.001	0.398	0.468	.			
369	4.03	0.001	0.468	0.544	0.903	.		
442B	2.77	0.002	0.001	0.001	0.001	0.001	.	
553	3.63	0.001	0.468	0.398	0.128	0.158	0.006	.

Table 14. Analysis of differences in mean volume for right inside point of German chocolate cakes

recipe no.	mean volume	recipes						
		242	442A	337	348	369	442B	553
		← p value →						
242	2.97	.						
442A	3.83	0.001	.					
337	4.03	0.001	0.349	.				
345	4.03	0.001	0.874	1.000	.			
369	3.80	0.001	0.874	0.277	0.277	.		
442B	3.30	0.138	0.022	0.003	0.003	0.030	.	
553	3.77	0.002	0.751	0.217	0.217	0.874	0.040	.

Table 15. Analysis of differences in volume for the five points of the German chocolate cakes

recipe no.	mean volume	recipes						
		242	442A	337	345	369	442B	553
		← p value →						
242	2.93	.						
442A	3.56	0.001	.					
337	3.85	0.001	0.076	.				
345	3.87	0.001	0.055	0.861	.			
369	3.83	0.001	0.096	0.896	0.760	.		
442B	3.05	0.461	0.004	0.001	0.001	0.001	.	
553	3.81	0.001	0.121	0.793	0.663	0.896	0.001	.

APPENDIX N

Analysis of Differences in Mean Sensory Ratings by Recipes

Table 16. Analysis of differences in mean ratings by recipe for crust color evenness of German chocolate cakes

recipe no.	mean rating	recipe no.						
		242	442A	337	345	369	442B	553
		← p value →						
242	3.85	.						
442A	10.86	0.001	.					
337	7.68	0.001	0.001	.				
345	8.44	0.001	0.020	0.430	.			
369	5.13	0.171	0.001	0.014	0.003	.		
442B	4.97	0.267	0.001	0.007	0.001	0.873	.	
553	10.113	0.001	0.353	0.110	0.098	0.001	0.001	.

Table 17. Analysis of differences in mean ratings by recipe for moistness of crumb of German chocolage cakes

recipe no.	mean rating	recipe no.						
		242	422A	337	345	369	442B	553
		← p value →						
242	11.19	.						
442A	7.68	0.001	.					
337	8.39	0.003	0.396	.				
345	7.84	0.001	0.866	0.514	.			
368	8.94	0.011	0.177	0.543	0.243	.		
442B	10.85	0.710	0.003	0.001	0.001	0.041	.	
553	8.32	0.003	0.380	0.932	0.588	0.502	0.014	.

APPENDIX O

Analysis of Differences in Mean Sensory Ratings by Panelists

Table 18. Analysis of differences in mean ratings by panelist for crust color evenness of German chocolate cakes

panel member	mean rating	1	2	3	4	5	6	7	8
		←			p value				→
1	7.30	.							
2	7.64	0.723	.						
3	3.81	0.001	0.001	.					
4	9.35	0.040	0.046	0.001	.				
5	5.64	0.083	0.013	0.028	0.001	.			
6	8.31	0.302	0.425	0.001	0.245	0.002	.		
7	7.20	0.932	0.644	0.001	0.033	0.096	0.270	.	
8	9.99	0.129	0.164	0.001	0.818	0.002	0.456	0.106	.

Table 19. Analysis of differences in sensory ratings by panelist for cell uniformity of German chocolate cakes

panel member	mean rating	panel member 1	2	3	4	5	6	7	8
		← p value →							
1	8.30	.							
2	8.40	0.706	.						
3	7.26	0.338	0.113	.					
4	10.27	0.067	0.082	0.003	.				
5	6.32	0.058	0.007	0.287	0.001	.			
6	9.97	0.221	0.310	0.017	0.487	0.001	.		
7	8.32	0.663	0.892	0.143	0.177	0.162	0.471	.	
8	9.71	0.268	0.356	0.036	0.639	0.004	0.919	0.475	.

Table 20. Analysis of differences in mean ratings by panelist for moistness of crumb of German chocolate cakes

panel member	mean rating	panel member							
		1	2	3	4	5	6	7	8
		← p value →							
1	8.34	.							
2	9.38	0.121	.						
3	8.19	0.874	0.049	.					
4	10.47	0.019	0.291	0.006	.				
5	10.19	0.034	0.460	0.009	0.706	.			
6	8.74	0.641	0.221	0.485	0.038	0.060	.		
7	7.18	0.256	0.005	0.254	0.001	0.001	0.089	.	
8	9.71	0.301	0.802	0.195	0.303	0.424	0.470	0.036	.

EVALUATION OF RECIPE ADJUSTMENT PROCEDURES OF FIVE COMPUTER SOFTWARE COMPANIES

by

SHARON TYE LAWLESS, R.D.

B.S., University of Missouri-Columbia, 1983

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Hotel, Restaurant,
Institution Management and Dietetics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1987

ABSTRACT

The purpose of this research project was to determine if differences exist in recipe adjustment procedures of computer software companies as assessed by analytical and sensory recipe evaluations. The study sample consisted of five computer companies. A foodservice director recommended from each company adjusted a home-size German chocolate cake recipe to 60 and 540 servings using their computer program. A questionnaire outlining production techniques was also completed.

The adjusted computer recipes were prepared by trained bakery personnel using standardized procedures. Cake samples were evaluated by a trained sensory panel for crust color evenness, cell uniformity, cell size, density, and moistness of crumb using an unstructured line scale. Cake volumes were also recorded using the ACC10-91 Index to Volume.

Recipe adjustment procedure information received from four of the five companies indicated that three companies used various factor methods while the other used the percentage method. Differences were noted in ingredient quantities among recipes adjusted in weights and those adjusted in measures. Calculated ingredient ratios were similar for the recipes in 60 servings. Production questionnaires completed by the foodservice directors indicated a variety of procedures and equipment would be used if chocolate cake recipes were prepared in quantity in their operation.

Volume measurements for cakes indicated differences between the computer recipes. Overall significant differences in volume were

noted between recipes in left outside, left inside, center, right inside, and average measurements. Significant differences also were noted for cakes prepared in weights and cakes prepared in measures.

Sensory panel ratings for cakes prepared from computer recipes indicated an overall significant difference between recipes in crust color evenness and moistness of crumb. Significant differences were also noted for cakes prepared in weights and cakes prepared in measures. Significant differences were found between the panelist's ratings for crust color evenness, cell uniformity, and moistness of crumb.